Driving exposure and crash risk as determinants of fatal crash rates among teenage drivers

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Introduction

- Traffic crashes account for 40% of deaths among 16-18 year olds.
- Graduated driver licensing (GDL) has been implemented in 49 states (except North Dakota) and the District of Columbia.
- GDL regulates licensing and driving behaviors among 16-17 year olds in three phases:
  - Extended learner phase, requiring supervised driving under any conditions for 6 to 12 months;
  - Intermediate phase, allowing unsupervised driving under low-risk conditions such as during daytime or when carrying less than one or two young passengers;
  - Full licensure phase, permitting unsupervised driving all the time.

Methods

- Using the decomposition methodology, we assessed the relative contributions of driving exposure (miles driven) and crash risk (crash incidence per miles driven) to population-based fatal crash rates (rate per person-years) for ages 16-17 (regulated by GDL) and 18 (beyond GDL regulation) when compared with 25-54 year olds.
- Data sources included the 2008-2009 Fatality Analysis Reporting System for fatal crashes, National Household Travel Survey for miles driven, and Census-derived resident population estimates

Decomposition of the fatal crash involvement rate into components

Fatal crash involvement rate (a)		**Driving exposure** (b)		**Fatal crash incidence** (c)
# fatal crashes / # person-years	=	# miles driven / # person-years	×	# fatal crashes / # miles driven

$$\frac{a_{16}}{a_{25-54}} = \frac{b_{16}}{b_{25-54}} \times \frac{c_{16}}{c_{25-54}} = ratio_b \times ratio_c$$

$$\text{Relative Contribution}_{b,c} = \frac{|\ln(ratio_{b,c})|}{|\ln(ratio_b)| + |\ln(ratio_c)|} \times 100\%$$

Results

- Relative to ages 25-54 years, the ratio of population-based fatal crash rate was 0.78, 1.30, and 1.85 for ages 16, 17, and 18.
- Compared with persons aged 25-54 years, the ratio of average annual miles driven was 0.13, 0.30, and 0.67 for ages 16, 17, and 18; the ratio of crash incidence was 6.1, 4.3, and 2.8 for ages 16, 17, and 18.
- The relative contribution of driving exposure to the difference in fatal crash rate was approximately 50% for ages 16-17, but 28% for age 18.

Table 1. Fatal crash rate, driving exposure, and fatal crash incidence by age group, United States, 2008-2009

Age	Mean No. of Fatal crashes	No. of resident population	No. of million miles driven	Fatal crash rate per 10,000 person-years	No. of miles per person-year	Fatal crash rate per 100 million miles
16	498.0	4,255,765	5,978	1.2	1,405	8.3
17	840.0	4,336,071	14,423	1.9	3,326	5.8
18	1,225.5	4,422,630	32,357	2.8	7,316	3.8
25-54	19,079.5	127,560,437	1,396,148	1.5	10,945	1.4

Table 2. Comparisons of the contributions of driving exposure and fatal crash incidence, by age group, United States, 2008-2009

Age (years)	Fatal crash rate per 10,000 person-years		No. of miles per person-year		Fatal crash incidence per 100 million miles	
	Ratio	% change	Ratio	% change	Ratio	% change
16 vs 25-54	0.78	-22	0.13	-87	6.10	510
17 vs 25-54	1.30	30	0.30	-70	4.26	326
18 vs 25-54	1.85	85	0.67	-33	2.77	177

Table 3. Relative contributions of driving exposure and fatal crash incidence to the differences in population-based fatal crash rate by age group vs 25-54, United States, 2008-2009

Age (years)	No. of miles driven per person-year	Fatal crash incidence per 100 million miles driven
16	53%	47%
17	45%	55%
18	28%	72%

Conclusions and Implications

- For 16 and 17 year olds, reduced driving offset their high crash incidence, making their fatal crash rates comparable to that for ages 25-54.
- These results suggest that the primary mechanism of GDL effectiveness is by reducing driving exposure among 16-17 year olds.
- For 18 year olds, increases in driving and continued elevated crash incidence contribute to an overall increased fatal crash rate.
- These findings suggest the need to further strengthen efforts to improve driving skills for not only 16-17 year olds, but also 18 year olds.
  - 1) defensive driving skills such as keeping a safe distance from the vehicle ahead;
  - 2) education on risky behaviors such as speeding, cell phone use, and drowsy driving.

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